

REMARKS

The following remarks are responsive to the Office Action mailed January 27, 2006.

Applicants respectfully request reconsideration of the present application.

Oath and Declaration

The Office Action states that the oath or declaration is defective. Applicants submit herewith a Supplemental Oath and Declaration pursuant to 37 CFR 1.76.

Objection to Drawings

The Office Action objects to the drawings under 37 CFR 1.83(a) as not showing every feature specified in claims 4 and 24. Applicants have amended claim 4 and respectfully submit that claim 4 is supported by Figure 1 at least because the amendment to claim 4 subsumes the limitations of claim 4 under operation 120 of Figure 1. Regarding claim 24, applicants respectfully traverse the objection to the drawings. Applicants respectfully submit that claim 24 recites limitations within a controller, which controller has antecedent basis in claim 21 and which is identified in Figure 5 by reference number 208.

Objections to the Specification

The Office Action objects to the applicants' 7/14/05 amendment to paragraph [0029] of the specification, on the grounds that the amendment introduces new matter into the disclosure. Paragraph [0029] has been amended to delete the purported new matter.

The Office Action objects to the applicants' 7/14/05 amendment to paragraph [0037] on the grounds that the amendment introduces new matter into the disclosure. Paragraph [0037] has

been amended to delete the purported new matter.

The Office Action objects to the applicants' 7/14/05 amendment to paragraph [0045] on the grounds that the amendment is not supported by the original application or the original claims. Applicants' have amended paragraph [0045] accordingly. Applicants respectfully remind the Examiner that the "controller" referenced in amended paragraph [0045] was claimed in the claims of the original application, filed August 29, 2003, and does not constitute new matter in the specification.

Objections to Claims 1, 21, 30 and 35

The Office Action objects to claims 1, 21, 30 and 35 because of a number of informalities. Applicants have amended claims 1 and 21 in the manner suggested by the Examiner. With respect to claim 30, applicants submit that the Examiner's suggested change from "parameters" to "parameter" in line 2 of claim 30 is inapposite because, as submitted in the applicants' previous response, the antecedent basis of "parameters" is found in claim 22, from which claim 30 depends. Applicants submit that "in-plane rotation parameters" is supported at least because there are in-plane rotation parameters disclosed with respect to projections A and B. With respect to claim 35, applicants submit that the Examiner's suggested change of dependency of claim 35 from claim 21 to claim 22 is inapposite because claim 35 already depends from claim 22, based on the applicants' corrected amendment filed 27 October 2005.

Objections to Claims 22-33, 35-37, 40-43 and 46-49

The Office Action objects to claims 22-33, 35-37, 40-43 and 46-49 as being dependent upon rejected base claims, but otherwise allowable. Applicants traverse the rejections of the base claims below.

Summary of Claim Rejections

Claims 38, 39, 44 and 45 have been rejected under 35 USC 102(b) as being anticipated by US Patent 5,901,199 of Murphy et al. (“Murphy”).

Claims 21, 23-25, 34, 38, 39, 44 and 45 have been rejected under 35 USC 103(a) as being unpatentable over US Patent Publication 2004/0092815 of Schweikard et al. (“Schweikard”) in view of US Patent 5,117,829 of Miller et al. (“Miller”) and further in view of Martin J. Murphy, “An Automatic Six-Degree-of-Freedom Image Registration Algorithm for Image-guided Frameless Stereotaxic Radiosurgery,” 24 Med. Phys. 857-866 June 1987 (“Murphy”).

Status of Claims

At the time the Office Action was mailed, claims 1-49 were pending in the application. In the present response, claims 1, 21 and 46 have been amended to correct informalities. Claim 4 has been amended as described above. Claims 21, 22, 38, 40, 44 and 46 have been otherwise amended as described below. The amended claims are supported by the specification and no new matter has been added. Claims 1-20 have been indicated as allowable. Therefore, the following comments are directed toward the rejected claims.

Claim Rejections Under 35 U.S.C. 102(b)

Claims 38, 39, 44 and 45 have been rejected under 35 U.S.C. 102(b) as anticipated by Murphy.

Claims 38 and 39

As currently amended, claim 38 recites:

A method, comprising:

acquiring x-ray images of a target volume in a first image plane and a second image plane, the x-ray images defining a present orientation of the target volume;

generating synthetic x-ray reference images of the target volume from 3-dimensional scan data representing a previous orientation of the target volume, the synthetic x-ray reference images corresponding to in-plane transformations and out-of-plane rotations of the target volume projected onto the first image plane and the second image plane; and

determining a difference between the present orientation of the target volume and the previous orientation of the target volume in three translational coordinates and three rotational coordinates by comparing in-plane transformation parameters and out-of-plane rotation parameters of the x-ray images and the synthetic x-ray reference images in the first image plane and the second image plane, **wherein determining said difference comprises searching the in-plane transformation parameters in the first image plane and the second image plane using a first similarity measure between the x-ray images and the synthetic x-ray reference images in a 3-dimensional multi-level search.**

(emphasis added).

Applicants respectfully submit that Murphy does not disclose a method including the limitation “**wherein determining said difference comprises searching the in-plane transformation parameters in the first image plane and the second image plane using a first similarity measure between the x-ray images and the synthetic x-ray reference images in a 3-dimensional multi-level search,**” as recited in amended claim 38.

Murphy discloses a method for registering a DRR to an x-ray image that applies feature masks to the DRR and x-ray image, extracts feature vectors from the DRR and x-ray image, and

searches in multiple dimensions to minimize differences between the DRR and the x-ray image using a chi-squared metric (Murphy, col. 4, line 37 to col. 5, line 40; Fig. 1). Murphy's search algorithm is multi-dimensional, but not multi-level as recited in amended claim 38. Accordingly, applicants respectfully submit that claim 38, as amended, is not anticipated by Murphy.

Given that claim 39 depends from claim 38, and includes all the limitations of claim 38, applicants respectfully submit that claim 39 is not anticipated by Murphy.

Claims 44 and 45

As currently amended, claim 44 recites:

A system, comprising:

a radiation source and an imaging system to generate 2D radiographic images of a target volume in a first image plane and a second image plane, the 2D radiographic images defining a present orientation of the target volume;

a 3D scan data generator to generate reconstructed 2D reference images of the target volume from 3D scan data representing a previous orientation of the target volume, the reconstructed 2D reference images corresponding to in-plane transformations and out-of-plane rotations of the target volume projected onto the first image plane and the second image plane; and

a controller coupled with the radiation source, the imaging system and the 3D scan data generator, the controller configured to:

determine a difference between the present orientation of the target volume and the previous orientation of the target volume in three translational coordinates and three rotational coordinates by comparing in-plane transformation parameters and out-of-plane rotation parameters of the 2D radiographic images and the reconstructed 2D reference images in the first image plane and the second image plane, **wherein to determine said difference the controller is configured to search the in-plane transformation parameters in the first image plane and the second image plane using a first similarity measure between the 2D radiographic images and the reconstructed 2D reference images in a 3-dimensional multi-level search.**

(emphasis added).

Applicants respectfully submit that Murphy does not disclose a system including the limitation "wherein to determine said difference the controller is configured to search the in-

plane transformation parameters in the first image plane and the second image plane using a first similarity measure between the 2D radiographic images and the reconstructed 2D reference images in a 3-dimensional multi-level search,” as recited in amended claim 44.

As noted above, Murphy discloses only a multi-dimensional search and does not disclose a multi-level search, as recited in amended claim 44. Accordingly, applicants respectfully submit that claim 44, as amended, is not anticipated by Murphy.

Given that claim 45 depends from claim 44, and includes all the limitations of claim 44, applicants respectfully submit that claim 45 is not anticipated by Murphy.

Claim Rejections Under 35 U.S.C. 103(a)

Claims 21, 23-25, 34, 38, 39, 44 and 45 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Schweikard in view of Miller and further in view of Murphy. Applicants submit that the present application and Schweikard were, at the time of the invention of the present application, owned by or subject to an obligation of assignment to Accuray, Incorporated. As such, Schweikard may not be used in rejecting claims of the present application under 35 U.S.C. § 103(c). Therefore, applicants request that the rejections of claims 21, 23-25, 34, 38, 39, 44 and 45 be withdrawn.

Conclusion

In view of the arguments and amendments set forth herein, applicants respectfully submit that all objections and rejections have been overcome, and that the present application is in condition for allowance. Applicants respectfully request that a timely Notice of Allowance be issued in this case.

If the Examiner believes a telephone interview would expedite the prosecution of this

application, the Examiner is invited to contact Richard Thill at (408) 720-8300 x 238.

If there are any additional charges, please charge our Deposit Account No. 02-2666.

Respectfully submitted,

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